MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

EME2036 - MANUFACTURING AND OPERATIONS MANAGEMENT

(ME/RE)

29 FEBRUARY 2020
2:30 p.m - 4:30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 7 pages including cover page, 4 questions and appendices.

2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the answer booklet provided.

Question 1

a) Table Q1(a) is the demand for consumer product in each of the last five months,

Table Q1(a):Monthly demand of consumer product

Month	1	2	3	4	5
Demand	1300	1700	1900	2300	2400

i. Use two month moving average to generate a forecast for demand in month 6.

ii. Apply exponential smoothing with a smoothing constant of 0.9 to generate a forecast for demand for demand in month 6.

iii. Use mean squared deviation (MSD),which of these two forecasts do you prefer and why?

[15 marks]

b) The ABC Company manufactures wooden table. Management schedules overtime every weekend to reduce the backlog on the most popular models. The automatic routing machine is used to cut certain types of edges on the top table. The following orders need to be scheduled for the routing machine Table Q1(b)

Table Q1(b) Schedule of routing machine

Order	Time Since Order Arrived (hours ago)	Estimated Machine Time (hours)	Due Date (hours from now)
1	6	10	12
2	5	3	8
3	3	15	18
4	1	9	20
5	0	7	21

i. Develop separate schedules by using the FCFS, SPT, and EDD rules. Compare the schedules on the basis of average flow time and average past due hours for any order.

ii. For each schedule, calculate the average WIP inventory.

[10 marks]

Continued ...

Question 2

a) The following information has been gathered for a product development project.

Table Q3

Activity	Activity (Weeks)	Immediate Predecessor (s)
A	4	-
B	10	-
C	5	A
D	15	B,C
E	12	B
F	4	D
G	8	E
H	7	F,G

i. Draw the network diagram.

ii. Calculate the total slack for each activity:Which activities are in critical path

[10 Marks]

b) Checkout time at a supermarket is monitored using a range and mean chart. Six samples which contain 20 observations per sample have been collected and the sample means and sample ranges have been computed as shown in Table Q2(b).

Table Q2: Sample of observations

Sample	1	2	3	4	5	6
Mean	3.06	3.15	3.11	3.13	3.06	3.09
Range	0.42	0.50	0.41	0.46	0.46	0.45

i. Calculate the centerline, upper and lower control limits for the range chart?

ii. Plot the range chart showing the centerline, upper and lower control limits.

[15 Marks]

Continued ...

Question 3

a) You are the manager of a local bank where three tellers provide services to customers. On average, each teller takes three minutes to serve a customer. Customers arrive, on average, at a rate of 50 per hour. Having recently received complaints from some customers that they waited a long time before being served, your boss asks you to evaluate the system.

i. What is the average utilization of the three-teller service system?
ii. What is the probability that no customers are being served by a teller or are waiting in line?
iii. What is the average number of customers waiting in line?
iv. On average, how long does a customer wait in line before being served?
v. On average, how many customers would be at a teller's station and in line?

[15 marks]

b) ABH book store is a larger retailer of popular books; demand for a particular book is at 32,000 books per year. It costs the book store RM10 to process an order to replenish stock and the holding cost is RM4 per book per year. Assume a constant lead time of 5 working days for an order arrival. No backordering is allowed. Assume 300 working days a year and no safety stock for books.

i. What is ABH book store optimal order quantity? [2 marks]
ii. What is the optimal number of orders per year? [2 marks]
iii. What is the optimum interval (in working days) between orders? [2 marks]
iv. What is the demand during the lead time? [2 marks]
v. What is the reorder point? [2 marks]

Continued ...

Question 4

a) BOM for product A, shown in Fig. Q2, and data from the inventory records are shown in Table Q3. In the master production schedule for product A, the MPS start row has 500 units in week 6. Develop the material requirements plan for the next 6 weeks for items B, C, and D. (Hint: You cannot derive an item's gross requirements unless you know the planned order releases of all its parents, or the MPS start row if one of its immediate parents is an end item.)

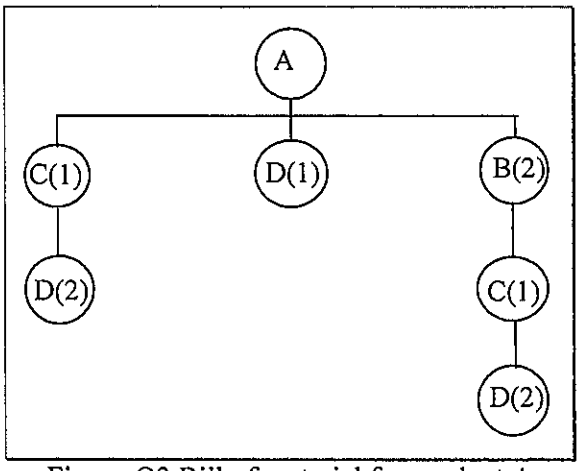

Figure Q3 Bill of material for product A

	Item		
Data Catergory	**B**	**C**	**D**
Lot size rule	L4L	L4L	FOQ= 2000
Lead time	3 weeks	1 weeks	1 weeks
Scheduled receipts	None	None	2000 (week 1)
Beginning inventory	0	0	200

[17 marks]

c) Lion Production., is a producer of educational video, they buys 400 blank CD's per month for producing educational material. The ordering cost of the CD's is RM12.50 and holding cost is RM0.12 per DVD per year.

i. Calculate the demand per year and order quantity of DVD's at a time.

ii. What is the time between orders?

[8 marks]

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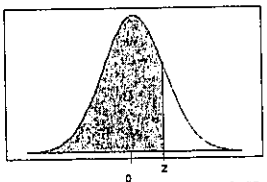
Appendix 1 Standard Normal Cumulative Probability Table



Cumulative probabilities for POSITIVE z-values are in the following table:

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990

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Appendix 2 Factors for calculating three-sigma limits for the x-chart and R-chart

Size of Sample (n)	Factor for UCL and LCL for x-Chart (A_2)	Factor for LCL for R-Chart (D_3)	Factor for UCL for R-Chart (D_4)
2	1.880	0	3.267
3	1.023	0	2.575
4	0.729	0	2.282
5	0.577	0	2.115
6	0.483	0	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777

Process capability:

$$C_{pk} = Minimum\ of \left[\frac{\bar{\bar{x}} - Lower\ specification}{3\sigma}; \frac{Upper\ specification - \bar{\bar{x}}}{3\sigma}\right]$$

$$C_P = \left[\frac{Upper\ specification - Lower\ specificaation}{6\sigma}\right]$$

Waiting Line Models Equations:

Single server	multiple server	Finite source
$\rho = \frac{\lambda}{\mu}$	$\rho = \frac{\lambda}{s\mu}$	$\rho = 1 - P_0$
$P_n = (1-\rho)\rho^n$	$P_n = \begin{cases} \frac{(\lambda/\mu)^n}{n!} P_0 & 0 < n < s \\ \frac{(\lambda/\mu)^n}{s!s^{n-s}} P_0 & n \geq s \end{cases}$	
$P_0 = 1 - \rho$	$P_0 = \left[\sum_{n=0}^{s-1} \frac{(\lambda/\mu)^n}{n!} + \frac{(\lambda/\mu)^s}{s!}\left(\frac{1}{1-\rho}\right)\right]^{-1}$	$P_0 = \left[\sum_{n=0}^{N} \frac{N!}{(N-n)!}\left(\frac{\lambda}{\mu}\right)^n\right]^{-1}$
$L = \frac{\lambda}{\mu - \lambda}$	$L = \lambda W$	$L = N - \frac{\mu}{\lambda}(1 - P_0)$
$L_q = \rho L$	$L_q = \frac{P_0(\lambda/\mu)^s \rho}{s!(1-\rho)^2}$	$L_q = N - \frac{\lambda + \mu}{\lambda}(1 - P_0)$
$W = \frac{1}{\mu - \lambda}$	$W = W_q + \frac{1}{\mu}$	$W = L[(N-L)\lambda]^{-1}$
$W_q = \rho W$	$W_q = \frac{L_q}{\lambda}$	$W_q = L_q[(N-L)\lambda]^{-1}$

End of paper